

ATTACHMENT A

**AVOIDED COSTS AND EXTERNALITY ADJUSTMENTS:
GENERIC INPUTS TO BE USED IN DUP
(OCTOBER 10, 2002)**

also includes certain risk adjustments

attachment consists of six single page spreadsheets

Attachment A-1: Direct Avoided Costs

Voltage # 4
Voltage Primary

	Energy and Ancillary Costs at Generation, Flat Load				Energy and Ancillary Costs at Secondary, Default Losses, Flat Load				Energy and Ancillary Costs with other Default Losses, Flat Load				
	Summer		Winter		Summer		Winter		Summer		Winter		
	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	
					Losses	17.97%	13.51%	19.88%	14.88%	12.58%	9.30%	14.01%	10.30%
2003	\$47.07	\$30.24	\$41.02	\$29.29		\$55.53	\$34.33	\$49.17	\$33.65	\$52.99	\$33.06	\$46.76	\$32.31
2004	\$47.07	\$30.24	\$41.02	\$29.29		\$55.53	\$34.33	\$49.17	\$33.65	\$52.99	\$33.06	\$46.76	\$32.31
2005	\$47.87	\$30.76	\$41.72	\$29.79		\$56.48	\$34.92	\$50.01	\$34.22	\$53.90	\$33.62	\$47.57	\$32.86
2006	\$48.68	\$31.28	\$42.42	\$30.29		\$57.43	\$35.51	\$50.86	\$34.80	\$54.80	\$34.19	\$48.37	\$33.41
2007	\$49.49	\$31.80	\$43.12	\$30.79		\$58.38	\$36.09	\$51.70	\$35.38	\$55.71	\$34.76	\$49.17	\$33.96
2008	\$50.29	\$32.31	\$43.83	\$31.29		\$59.33	\$36.68	\$52.54	\$35.95	\$56.62	\$35.32	\$49.97	\$34.52
2009	\$51.10	\$32.83	\$44.53	\$31.80		\$60.28	\$37.27	\$53.38	\$36.53	\$57.53	\$35.89	\$50.77	\$35.07
2010	\$53.02	\$34.07	\$46.20	\$32.99		\$62.55	\$38.67	\$55.39	\$37.90	\$59.69	\$37.24	\$52.68	\$36.39
2011	\$54.90	\$35.28	\$47.85	\$34.16		\$64.77	\$40.04	\$57.36	\$39.25	\$61.81	\$38.56	\$54.55	\$37.68
2012	\$56.86	\$36.53	\$49.55	\$35.38		\$67.07	\$41.47	\$59.40	\$40.64	\$64.01	\$39.93	\$56.49	\$39.02
2013	\$58.88	\$37.83	\$51.31	\$36.64		\$69.46	\$42.94	\$61.51	\$42.09	\$66.28	\$41.35	\$58.50	\$40.41
2014	\$60.98	\$39.18	\$53.14	\$37.94		\$71.93	\$44.47	\$63.70	\$43.59	\$68.65	\$42.83	\$60.58	\$41.85
2015	\$63.24	\$40.63	\$55.11	\$39.35		\$74.60	\$46.12	\$66.06	\$45.20	\$71.19	\$44.41	\$62.83	\$43.40
2016	\$65.69	\$42.21	\$57.25	\$40.88		\$77.50	\$47.91	\$68.63	\$46.96	\$73.96	\$46.14	\$65.27	\$45.09
2017	\$68.14	\$43.78	\$59.37	\$42.40		\$80.38	\$49.69	\$71.18	\$48.71	\$76.71	\$47.85	\$67.70	\$46.76
2018	\$70.67	\$45.41	\$61.58	\$43.98		\$83.37	\$51.54	\$73.83	\$50.52	\$79.56	\$49.63	\$70.21	\$48.50
2019	\$73.31	\$47.10	\$63.88	\$45.62		\$86.48	\$53.47	\$76.58	\$52.40	\$82.53	\$51.49	\$72.84	\$50.32
2020	\$76.05	\$48.87	\$66.28	\$47.33		\$89.72	\$55.47	\$79.45	\$54.37	\$85.62	\$53.42	\$75.56	\$52.20

Escalation after 2020: 3.7%

NOTES

Summer Includes April through November.

Winter Includes Dec through March.

Cumulative Losses by Period and Voltage

Velco	3.5%	2.5%	3.9%	2.8%
sub-trans	4.9%	3.5%	5.5%	3.9%
Dist s/s	5.7%	4.1%	6.4%	4.6%
Primary	12.6%	9.3%	14.0%	10.3%
Secondary	18.0%	13.5%	19.9%	14.9%

Incremental Losses by Period and Voltage

Velco	3.5%	2.5%	3.9%	2.8%
sub-trans	1.4%	1.0%	1.6%	1.1%
Dist s/s	0.9%	0.6%	1.0%	0.7%
Primary	7.3%	5.4%	8.2%	6.0%
Secondary	6.2%	4.6%	6.8%	5.1%

Attachment A-1: Direct Avoided Costs

Energy and Ancillary Costs at Secondary, Default Losses, Default Load Shape				
	Summer		Winter	
	Peak	Off-Peak	Peak	Off-Peak
Load-shape Adj	3.3%	2.6%	1.9%	2.0%
	\$57.36	\$35.23	\$50.08	\$34.31
	\$57.36	\$35.23	\$50.08	\$34.31
	\$58.34	\$35.83	\$50.94	\$34.89
	\$59.33	\$36.44	\$51.80	\$35.48
	\$60.31	\$37.04	\$52.65	\$36.07
	\$61.29	\$37.64	\$53.51	\$36.66
	\$62.27	\$38.25	\$54.37	\$37.24
	\$64.62	\$39.68	\$56.41	\$38.64
	\$66.91	\$41.09	\$58.42	\$40.02
	\$69.29	\$42.55	\$60.50	\$41.44
	\$71.75	\$44.07	\$62.65	\$42.91
	\$74.31	\$45.64	\$64.88	\$44.44
	\$77.06	\$47.33	\$67.28	\$46.09
	\$80.06	\$49.17	\$69.90	\$47.88
	\$83.04	\$51.00	\$72.50	\$49.66
	\$86.13	\$52.90	\$75.19	\$51.51
	\$89.34	\$54.87	\$78.00	\$53.43
	\$92.69	\$56.92	\$80.92	\$55.43

Attachment A-1: Direct Avoided Capacity

Part 2: Installed Capacity with Reserves(\$/kW-yr.)

Voltage # 4
Voltage Primary

		Retail for EVT Periods					
		Secondary Losses			Other Losses		
		Winter	Summer	Spring and Fall	Winter	Summer	Spring and Fall
<i>Period Ratios</i>		0.39	0.60	0.30	0.39	0.60	0.30
<i>Losses</i>		14.2%	14.2%	14.2%	9.8%	9.8%	9.8%
Wholesale							
2003	\$9.60	\$4.28	\$6.58	\$3.29	\$4.11	\$6.32	\$3.16
2004	\$9.60	\$4.28	\$6.58	\$3.29	\$4.11	\$6.32	\$3.16
2005	\$13.65	\$6.08	\$9.35	\$4.68	\$5.84	\$8.99	\$4.50
2006	\$19.40	\$8.64	\$13.30	\$6.65	\$8.31	\$12.78	\$6.39
2007	\$27.59	\$12.29	\$18.90	\$9.45	\$11.81	\$18.17	\$9.09
2008	\$39.22	\$17.47	\$26.87	\$13.44	\$16.79	\$25.84	\$12.92
2009	\$55.75	\$24.83	\$38.20	\$19.10	\$23.88	\$36.73	\$18.37
2010	\$57.20	\$25.48	\$39.20	\$19.60	\$24.50	\$37.69	\$18.84
2011	\$58.69	\$26.14	\$40.21	\$20.11	\$25.13	\$38.67	\$19.33
2012	\$60.22	\$26.82	\$41.26	\$20.63	\$25.79	\$39.67	\$19.84
2013	\$61.78	\$27.52	\$42.33	\$21.17	\$26.46	\$40.70	\$20.35
2014	\$63.39	\$28.23	\$43.43	\$21.72	\$27.15	\$41.76	\$20.88
2015	\$65.04	\$28.97	\$44.56	\$22.28	\$27.85	\$42.85	\$21.42
2016	\$66.73	\$29.72	\$45.72	\$22.86	\$28.58	\$43.96	\$21.98
2017	\$68.46	\$30.49	\$46.91	\$23.46	\$29.32	\$45.10	\$22.55
2018	\$70.24	\$31.28	\$48.13	\$24.07	\$30.08	\$46.28	\$23.14
2019	\$72.07	\$32.10	\$49.38	\$24.69	\$30.86	\$47.48	\$23.74
2020	\$73.94	\$32.93	\$50.67	\$25.33	\$31.66	\$48.72	\$24.36

Escalation after 2020: 2.6%

Cumulative Losses by Voltage

Velco	2.7%
sub-trans	3.7%
Dist s/s	4.3%
Primary	9.8%
Secondary	14.2%

Incremental Losses by Voltage

Velco	2.7%
sub-trans	1.1%
Dist s/s	0.7%
Primary	5.7%
Secondary	4.9%

Attachment A-2: Avoided Costs of Non-Targeted T&D

Full Values

		Velco		Company		Distribution		
	Total	Transmission		Subtransmission				
		Subs	Lines	Subs	Lines	Subs	Primary	Secondary
Percentage	100%	6%	3%	13%	18%	29%	26%	5%
Year-2002 \$/kW-yr.	\$96.4/kW-yr	\$5.8	\$2.9	\$12.5	\$17.4	\$28.0	\$25.1	\$4.8
With losses to secondary	\$110.1/kW-yr	\$6.6	\$3.3	\$14.3	\$19.8	\$31.9	\$28.6	\$5.5
With losses to primary	\$108.9/kW-yr	\$6.5	\$3.3	\$14.2	\$19.6	\$31.6	\$28.3	

Rules for Inclusion of Non-targeted T&D

Secondary

Full value immediately

Other voltages not specifically reviewed

Full value immediately

Other voltages for which no equipment is targeted

Methodology to be developed in extended collaborative

Voltages for which some equipment is targeted

Methodology to be developed in extended collaborative

Attachment A-3

Part 2: Externality Examples (2002 Dollars)

		Large Gas Combined Cycle		Uncontrolled Diesel Engine		Micro Turbine		3-way Catalyst Gas-Fired Rich Burn IC Engine		Small Gas Turbine		Phosphoric Acid Fuel Cell	
Characteristics													
Efficiency %(HHV)		51%		38%		25%		29%		27%		37%	
Btu/kWh		6,640		8,982		13,652		11,769		12,780		9,224	
Typical Capacity (kW)		500,000		1,000		25		1,000		4,600		200	
Fuel		Natural Gas		Diesel		Natural Gas		Natural Gas		Natural Gas		Natural Gas	
	Scaled \$/lb												
Externalities	2002\$	lb/MWh	\$/MWh	lb/MWh	\$/MWh	lb/MWh	\$/MWh	lb/MWh	\$/MWh	lb/MWh	\$/MWh	lb/MWh	\$/MWh
NO _x	\$2.8737	0.06	0.17	21.8	62.52	0.44	1.27	0.5	1.34	1.15	3.30	0.03	0.10
SO ₂	\$0.6786	0.004	0.00	0.454	0.31	0.008	0.01	0.007	0.00	0.008	0.01	0.006	0.00
PM-10	\$3.5125	0.04	0.15	0.78	2.73	0.09	0.32	0.03	0.11	0.08	0.30	-	-
CO ₂	\$0.0095	776	7.39	1,432	13.64	1,596	15.20	1,376	13.11	1,494	14.23	1,078	10.27
CO	\$0.3832	0.1	0.03	6.2	2.38	1.2	0.46	4.0	1.54	0.7	0.27	-	-
UHC	\$2.3553	0.05	0.11	1.2	2.93	0.42	1.00	0.4	0.95	1.10	2.59	-	-
TOTAL \$/MWh		\$7.86 ^a		\$84.51		\$18.25		\$17.05		\$20.70		\$10.37	

Cogeneration Environmental Credit (assumes same fuel in avoided boiler)

Total Cogen. Effic. 80%

Avoided Boiler Effic. 85%

Fraction of Input Energy Saved by Cogeneration

SO₂ Emission Credit (lb/MWh)

CO₂ Emission Credit (lb/MWh)

Net Environmental Cost with Cogeneration^b

49%		65%		60%		63%		51%	
0.224	\$6.89	0.005	\$9.84	0.004	\$7.87	0.005	\$8.93	0.003	\$5.20
707		1,032		825		937		545	
\$77.62		\$8.41		\$9.18		\$11.77		\$5.17	

NOTES

^a For system supply, externalities should be computed for the change in load times line losses from load to generation.

^b Cogeneration credits should be added for other pollutants, based on the emissions of the avoided boiler.

Attachment A-3

Part 3: Risk Adjustments

Equivalent Risk Adjustments

Docket No. 5270 presents the risk adjustment as a 10% reduction in DSM cost, which is equivalent to an 11.1% increase in avoided costs. Use of either risk column will provide the same comparisons between resources, so long as one column is used consistently in the analysis.

	Risk Adjustment As	
	<i>Cost Adder</i>	<i>Docket 5270 Cost Discount</i>
Energy Efficiency		
(includes fuel switching)	0%	-10.0%
System Power	11.1%	0.0% ^a
T&D	11.1%	0.0% ^a
Load Management	To be Determined in ASCs	
Distributed Generation	To be Determined in ASCs	

NOTES

*All resources are discounted for participation, persistence, coincidence, free riders and other expected reductions.
Costs are net of customer benefits: avoided fuel cost for CHP, avoided backup generators for DG*

^a *These are default values; the ASCs may adjust them so long as the average is consistent with the default*